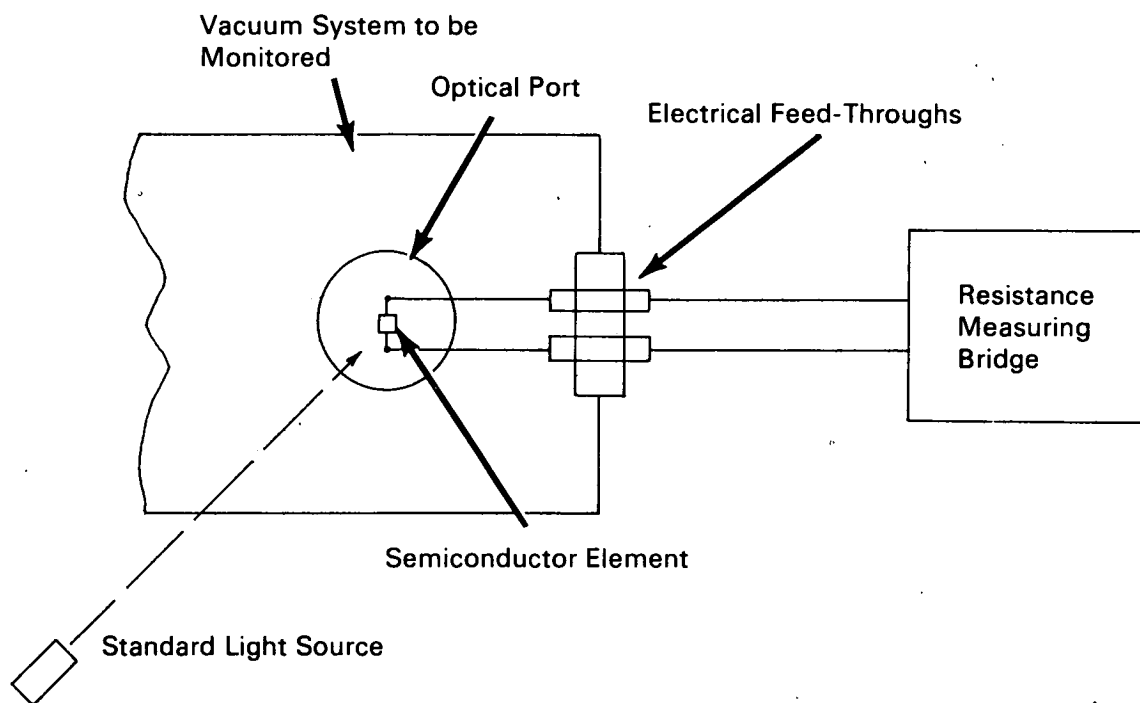


NASA TECH BRIEF



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Concept for Improved Vacuum Pressure Measuring Device



Schematic Drawing For Low Pressure Measuring Concept

This concept for measuring vacuum pressures in the range from 5×10^{-7} to 5×10^{-16} torr should prove of interest to research and development manufacturers of vacuum tube and related measuring devices. The basic element upon which the measuring concept depends is a semiconductor resistor, composed of sintered zinc oxide. Through the effect of surface adsorbed gases on the resistance of semiconductor materials, very low pressures can be measured. No existing techniques are capable of

measuring low vacuum pressures below 10^{-14} torr. Above this pressure range, the standard procedure has been to employ some form of electron bombardment-ionization system.

In measuring very low pressures, the development of sensing elements uniquely sensitive to specific gas species has been an important area of research. The key element should have a large surface to volume ratio, and the carrier concentration of electrons in the bulk which dominates the resistance charac-

(continued overleaf)

teristics of the specimen should be highly sensitive to the surface adsorption of the species to be measured.

There are several methods which can be used to measure very low pressures. One approach is to monitor the resistance of the semiconductor element as a function of time under the vacuum conditions to be monitored before, during, and after illumination to visible light of moderate intensities. This light source can be inside or outside of the vacuum system.

An alternate method is to substitute the standard light source inside the vacuum system with a simple filament placed in a pertinent geometrical relationship to the resistance element. This light source cleans the semiconductor surfaces by specific mechanisms. The decay or increase in the resistance following the cleaning procedure is then monitored by the resistance bridge. By means of appropriate calibration, a direct reading of the vacuum conditions can be obtained.

Another procedure substitutes heat for photon light and cleans the resistance element with temperatures in the vicinity of 400°C. This can be achieved by a filament placed near the filament. A heat sink contact and standard flashing techniques can also be employed.

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Notes:

For further information on the theory of this concept, see:

1. J. of Chemical Physics, vol. 28, #5, May 1958, pp. 870-873.
2. J. of Physics and Chemistry of Solids, vol. 20, #3/#4, pp. 255-267. Published in Great Britain.
3. This development is in a conceptual stage only, and as of date of publication of this Tech Brief, neither a model nor prototype has been constructed.
4. No further documentation is available.

Patent status:

No patent action is contemplated by NASA.

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